Storm Water Monitoring Techniques

Speaker Background - Presentation Summaries

Welcome and Program Overview

Mark Rayback, PE - Background

Mark Rayback was recently appointed Chief Environmental Engineer for the Department of Transportation. His responsibilities include overseeing the Departments Stormwater, Noise, Vibration, and Hazardous Waste functions.

Mr. Rayback has been with the Department of Transportation for about 11 years. His prior work for the Department has included:

- Special assignment to implement Program/Project Management Division in the Information Technology function.
- Worked as Assistant District Director in District 11 - which covers San Diego and Imperial County.
- AB 1012 MIS Project Manager - developed a report to the Legislature entitled "Improving California's Transportation Project Delivery through better Information Management."
- Project Manager for the Project Resource and Schedule Management System - a three-year, $15 million project aimed at providing the Department a state-of-the-art suite of program/project management tools.
- Project Manager for numerous Transportation Improvement Projects and Project Engineer for numerous Transportation Improvement projects.

Mark Rayback is a graduate of CSUS with B.S. in Civil Engineering.

The Monitoring Challenge

Armand Ruby, M.S., Moderator - Background

Armand Ruby is an Associate with Larry Walker Associates, specializing in ambient water quality impacts assessment, stormwater quality, and watershed management. Armand has over 20 years of experience in the environmental field. He has designed and managed storm water monitoring programs for a number of municipal NPDES Permittees, including the communities of Bakersfield, Davis, Sacramento, San Bernardino, Stockton, and Ventura. He serves as project manager for the production of the Caltrans Storm Water Monitoring Protocols Guidance Manual and other Caltrans storm water monitoring program reports. Armand has managed the development of complex Access databases for large storm water programs, including the Caltrans data management system, and overseen the development of graphical user interfaces for storm water and watershed management projects. He is an expert in the area of water quality data analysis, and has presented study results at state and national professional conferences. Armand is an active member of the Monitoring and Science committee of the California Storm Water Quality Task Force.

Thomas Howard, M.S., Speaker – Background

Thomas Howard has been employed with the State Water Resources Control Board for over 17 years. During that time, Mr. Howard has worked in many of the water quality and water rights programs at the Board. He was appointed Deputy Director at the Board in October 2000. The principal focus of his position is on the Board's water quality programs.

Mr. Howard has earned a bachelor's degree in chemistry at U.C. Berkeley, a master's degree in chemical engineering at U.C. Davis, and a master's degree in chemistry at Caltech.

The State Water Resources Control Board and nine Regional Boards have 1,775 positions statewide, and a combined annual budget of approximately $650 million. The Board's mission is to preserve, enhance and restore the quality of California's water resources, and ensure their efficient use to benefit present and future generations.

Geoff Brosseau, Speaker - Background

Mr. Brosseau is an environmental consultant specializing in water quality, particularly wastewater and storm water. He provides assistance to local and state agencies in California in the areas of program development and management, best management practices, special studies, expert witness services, guidance manuals and training, and small business and public education.

Geoff is the Executive Director of BASMAA (Bay Area Stormwater Management Agencies Association), a consortium of the seven countywide urban runoff programs in the San Francisco Bay Area, representing 90 agencies, including 79 cities and 5 counties. He was one of the principal authors of the California Storm Water Best Management Practice Handbooks and is a principal author of national guidance manuals on pollution prevention. He is also an active participant on the California Stormwater Quality Task Force and also participated on WERF Project Subcommittees overseeing studies of Source Control Programs and Stormwater Environmental Indicators.

Geoff's monitoring experience ranges from laboratory and fieldwork to project management to strategic planning. Over the last twelve years, his monitoring experiences have included: managing individual studies such as a County of Sacramento investigation of gas station BMPs to developing strategies and plans like BASMAA's Regional Monitoring Strategy and a long-term monitoring and assessment plan for San Francisquito Creek and its tributaries.

Geoff Brosseau - Presentation Summary

Guiding Principles & Lessons Learned for More Effective Monitoring Programs

Decision-makers rarely have as much information as they need to make a completely informed decision. Monitoring is often suggested as a way to help fill this information gap. Unfortunately, by its very nature, monitoring can be quite expensive. But monitoring does not have to be relatively expensive compared to other expenditures if it is designed to be effective – both economically as well as technically. Effective means that the information provided is as valuable as it can be in making management decisions or taking action. The value of monitoring information depends on keeping certain guiding principles and lessons learned in mind at all times. To the extent that this is done is the extent to which monitoring is not just an investment but also a critical aspect of decision-making and vital to determining program effectiveness. Storm water scientists and storm

The Monitoring Challenge (continued)

water managers can help each other become more effective by integrating more science into the management of storm water and more management into storm water science.

The Caltrans Monitoring Experience

John Johnston, Ph.D., PE, Moderator - Background

John Johnston is a professor of Civil Engineering at California State University Sacramento. For the past three years he has been working with the Caltrans Storm Water Research Program, providing technical assistance in the development of treatment Best Management Practices. Before coming to Sac State, John was an associate professor at CSU Fresno, and before that worked as a civil engineer with Camp Dresser and McKee and the Army Corps of Engineers.

Kuen Tsay, PE, Speaker - Background

As part of the California Department of Transportation (Department) Division of Environmental Analysis Storm Water Management Program, Mr. Tsay manages the Department's Statewide Storm Water Monitoring and Research Activities. The monitoring activity is composed of over 100 monitoring stations throughout the state with an annual budget of over 10 millions dollars. The research activity involves pathogens, herbicides, erosion control and economic analysis. Mr. Tsay works with University of California, California State University researchers and consultants to develop and assess best management practices for permanent storm water management and for temporary erosion and sediment control.

Kuen Tsay - Presentation Summary

Overview of the Caltrans Statewide Monitoring Program

Since the Department obtained its first statewide NPDES Permit for Storm Water Discharges in July 15, 1999 the Department has worked continually to comply with its Permit requirements. As part of the Permit requirement, the Department is currently monitoring approximately 120 sites throughout the state. These sites are consist of congested and free flowing highway, construction, highway, maintenance yard, park and ride, rest area, toll plaza, and weigh station. In conjunction, the Department is also conducting some specialized characterization studies such as CTR, drain inlet cleaning efficacy, first flush, herbicide, litter, pathogen, and toxicity.

NPDES Phase 2 and TMDL are the latest challenges for managing storm water for existing and new highways. The Department has taking the initiative to meet these requirements through Research Program with Universities.

The Caltrans Monitoring Experience (continued)

Armand Ruby – Presentation Summary

The Caltrans Stormwater Monitoring Protocols Guidance Manual

The Caltrans Guidance Manual for Stormwater Monitoring Protocols provides detailed information on stormwater quality monitoring equipment and procedures. The manual is designed and organized to provide step-by-step descriptions of the measures involved in planning and implementing a successful stormwater quality monitoring program. The manual is used throughout California by Caltrans staff and contractors to plan and implement monitoring programs for runoff from transportation-related facilities. The main objective of the manual is to provide consistency in monitoring methods among the various Caltrans runoff monitoring programs and projects. Such consistency is essential to provide for data comparability, and for ease of data entry in the Caltrans stormwater database. The manual provides comprehensive specifications for sampling and analysis to ensure that the resulting data are accurate and precise. To that end, the manual features detailed information on quality assurance and quality control procedures. The focus of this guidance manual is on sampling and analysis for chemical and physical constituents, as part of a stormwater quality monitoring program. Supplemental monitoring approaches that can be used to support water quality monitoring, including sediment chemistry monitoring, toxicity testing, use of biological or physical indicators, and visual monitoring are also briefly discussed in Appendix A of the manual. Caltrans has recently produced separate guidance manuals for toxicity study protocols and sediment monitoring protocols.

Edward F. Othmer, Jr., M.S., PE, Speaker - Background

Edward Othmer is a Principal Water Resources Engineer with URS and has over nine years of storm water monitoring and research-related experience. Mr. Othmer received his M.S. in Civil Engineering with emphasis in Water Resources Engineering from Tufts University. Mr. Othmer is a registered civil engineer and is a Caltrans technical advisory group member for the preparation of the Caltrans Guidance Manual: Stormwater Monitoring Protocols. Mr. Othmer has managed a variety of large-scale storm water programs for Caltrans and the U.S. Navy including 25 storm water monitoring and research projects for Caltrans.

Edward F. Othmer, Jr. – Presentation Summary

Field Monitoring

Regulatory framework such as National Pollutant Discharge Elimination System (NPDES) Permits, Total Maximum Daily Loads (TMDLs), and the California Toxics Rule (CTR) have stressed the importance of properly characterizing discharges. Meeting these stringent regulations has shown to be challenging from a practical standpoint. Most of the current regulations require that storm water monitoring be done by trained personnel and high-tech equipment. With the onset of automated sampling stations, some of the practical challenge has been minimized, but additional monitoring challenges have been created. During the past several years, the California Department of Transportation (Caltrans) has taken a proactive approach of incorporating field monitoring lessons learned into their *Stormwater Monitoring Protocols Guidance Manual* to improve their sample collection techniques and other aspects of their monitoring program. This presentation is an overview of some of those lessons learned in collecting representative samples.

The Caltrans Monitoring Experience (continued)

Richard Amano, Speaker - Background

Mr. Amano is the Principal Chemist with Laboratory Data Consultants, Inc. He has over 20 years of environmental laboratory, QA/QC, and data validation experience. He has directed several data validation and software development projects for the Army Corps of Engineers, Navy, AFCEE, and Caltrans. Prior to founding LDC in 1991, he directed to two major laboratories, Analytical Technologies, Inc. and Brown and Caldwell from 1983 to 1991. He also has overseen several laboratory audits for major analytical testing programs for the Navy, Shell Oil, Texaco, and Hewlett-Packard. His laboratory experience includes hands-on CLP and SW-846 GC/MS analysis, direction of GC/MS (including TO-14 air analyses) and radiochemistry groups, dioxins method development, and complex GC data interpretation of Aroclors. He has performed expert witness support for litigation purposes. Mr. Amano received a B.S. in Biochemistry from UCLA in 1979.

Richard Amano – Presentation Summary

Data Reporting and QA/QC

Laboratory Data Consultants, under a contract with Caltrans Storm Water Management Program through Law Crandall designed and developed a computer application for assessing analytical data presented in an electronic data deliverable (EDD) format. The Caltrans automated data validation application was developed to standardize electronic monitoring data, improves EDD integrity and quality, and provides a cost effective, expedited process to support technical staff in evaluating analytical data. This application, developed within Microsoft Access 97, performs a verification check and automated data validation on a Caltrans-specific formatted EDD. The EDD format uses data fields specified in the Caltrans 2000-2001 Data Reporting Protocols and additional data fields that include quality control batch links and routine accuracy and precision parameters such as surrogate, matrix spike, and laboratory control sample recoveries. The application imports an EDD and verifies completeness and conformance with EDD format specifications. Analytical results from related test methods are compared for technical consistency. An error report provides detail for each EDD non-conformance and technical inconsistency. Automated data validation uses a reference project library that contains quality control (QC) and validation criteria specific to the project at hand. The application validates EDDs against these project requirements and a modified version of the EPA Functional Guidelines. Command buttons generate a variety of data validation and QC outlier reports. Database forms also provide on-line review and allow documented editing of data qualifiers, if necessary. A historical assessment report indicates when analytical results fall outside historical ranges. After validation and review, the EDD can be exported either as a text file or Microsoft Excel spreadsheet containing the fields and field order specified in the Caltrans 2000-2001 Data Reporting Protocols.

Masoud Kayhanian, Ph.D., Speaker – Background

Dr. Kayhanian obtained his Ph.D. from UC Davis in Environmental and Biological Systems Engineering. He is an active member of the Center for Environmental and Water Resources Engineering in the Department of Civil and Environmental Engineering at the University of California, Davis. He is currently assisting Caltrans on water quality research and monitoring issues, data management, and load modeling. Prior to this appointment, Dr. Kayhanian worked as research faculty for six years in the Department of Civil and Environmental Engineering where he

directed the UC Davis high-solids bio-gasification project, and taught several undergraduate and graduate courses. Dr. Kayhanian has worked for different private consulting firms over the past ten

The Caltrans Monitoring Experience (continued)

years and solved many different challenging environmental problems. He has been a member of scientific committees for different state organizations and an elected member of the board of Directors for the UC Davis Cal Aggie Alumni Association. He is a contributing editor of *Stormwater,* the Journal for Surface Water Quality Professionals. Dr. Kayhanian has authored and co-authored over 60 journal papers and conference proceedings and has received numerous honors and awards for his accomplishments. He is the architect behind some of the documentation and software applications presented during this workshop.

Masoud Kayhanian – Presentation Summary

Data Analysis and Interpretation

Consistent methods of reporting all monitoring data will be discussed. A user-friendly database will be demonstrated to show proper data management, retrieval, and analysis. Special emphasis will be given to data analysis and its implications on assessing water quality. The conclusions made from this presentation are as follows:

- Without proper data QA/QC, the validity of monitoring data is questionable.
- All monitoring data should be reported in a consistent manner, in order to be fully utilized.
- A useful and user-friendly database is essential to store and retrieve monitoring data for continuous data analysis and to measure program success.
- A significant number of storm water runoff quality data contain large numbers of non-detects
- Detection limits set by analytical laboratories can affect the number of non-detects (NDs) in water quality data.
- Depending on data distribution, number of NDs, and statistical method, a large variation in mean values can be observed.
- Variation in mean values can significantly affect the constituent mass loading estimation.
- Statistical approaches in analyzing the water quality data with non-detects may affect the TMDL compliance requirements.

Storm Water Monitoring – More Challenges

Edward D. Schroeder, Ph.D., Speaker - Background

Edward D. Schroeder was a Professor of Civil & Environmental at the University of California, Davis from 1966 to 2000. Since retirement he has continued to conduct research on biological processes and water quality management and to teach courses on wastewater treatment and serve as the director of the Center for Environmental & Water Resources Engineering. Professor Schroeder received his B.S. C.E. and M.S. C.E. degrees from Oregon State University in 1961 and 1962, respectively and the Ph.D. (chemical engineering) from Rice University in 1967. He has published

over 150 technical articles and reports and three books dealing with environmental quality management and consulted for numerous environmental groups, communities, industries, and firms.

Storm Water Monitoring – More Challenges (continued)

Edward D. Schroeder - Presentation Summary

Management of Pathogens Associated with Storm Drain Discharge

In 2001 there were 795 beach postings and 115 beach closures in Los Angeles, Orange, and San Diego counties because of high concentrations of indicator organisms in the surf zone. Urban drainage, including both dry weather flow and storm runoff have been implicated as sources of the high bacterial concentrations although in most cases the sources have not been identified. A considerable economic loss results from many beach closings and there is an assumed significant risk to public health because of the implied presence of pathogenic organisms when indicator counts are high.

In the work reported here, molecular biological methods were used to detect viral, bacterial, and protozoan pathogens associated with waterborne diseases. In each case indicator organism concentrations were monitored, also. The studies were divided into two phases. Baseline studies were conducted to determine if indicator organism and pathogens are present in runoff from parks, residential lawns and roofs, and creeks. Field studies were conducted in which dry and wet weather sampling was conducted in storm drains discharging to beaches and at highway facilities. As with the baseline studies, both indicator organisms counts and pathogen detection monitoring was done in the field studies.

The baseline studies consisted of 49 samples taken at 35 sites. Pathogens were detected in 10 samples. In the field studies pathogens were detected in 12 of the 97 samples taken at 18 sites. A correlation between the presence of pathogens and the indicator organism concentrations was not found. Pathogens were not detected in some of the samples having the highest indicator organism concentrations while pathogens were detected in samples having relatively low indicator organism counts

Richard Tveten, M.S., Speaker – Background

Richard Tveten is the Water Quality Team Leader for the Washington State Department of Transportation. Prior to this position, Mr. Tveten was the WSDOT Statewide Erosion Control Coordinator. He also served as an environmental consultant specializing in polymer treatment of construction runoff, erosion control, and wetland/stream/wildlife studies.

Mr. Tveten has a Masters of Science (specializing in Fire Ecology) from Western Washington University.

Key Monitoring Issues – A Poster Display

Seema Datta, Ph.D., Presenter – Background

As a part of the research team of Professor Young at the University of California, Davis, Department of Civil and Environmental Engineering, Dr. Seema Datta, leads research activities in monitoring storm water from Caltrans facilities for priority toxic pollutants listed in the California Toxics Rule (CTR). She specializes in the design of field equipment for sample collection, and in

the development of analytical methods for the analysis of trace organic contaminants in water and other matrices. She manages the method development and pilot testing treatment strategies for storm water runoff so that Caltrans may establish compliance with CTR water quality criteria.

Key Monitoring Issues – A Poster Display (continued)

Seema Datta, Luat V. Do., Rodelia R. Busalpa, and Thomas M. Young - Presentation Summary

California Toxics Rule

This presentation centers on challenges encountered in the development of storm water collection and analysis of California Toxics Rule (CTR) priority toxic pollutants from a Caltrans Maintenance Yard and highway site. Our focus is the organic compounds since they pose a greater analytical challenge than the metals group. Specifically, we discuss the need to collect high volume storm water (20 - 35 L) in order to meet the sensitivity requirements of the numeric water quality criterion for CTR. To address this issue, we have modified and built new field sampling equipment. We detail an automated set up for the collection of high volume storm water using an autosampler, in-line filtration and a holding vessel from which filtered water is by a second pumped through XAD columns for on-site extraction of organics. Additionally we employ a special autosampler for volatile organic compounds so that the collection is gas tight, ensuring sample integrity. We have constructed a custom-built rain sampler that also samples real time and in-situ. Analysis of the rainwater and storm water will determine the atmospheric loading into storm water. The operation of this apparatus is described in detail. All field equipment is powered by 12 V batteries that are recharged by solar panels. Some of results of the analysis of storm water collections this past rainy season (2001-2002) show no detection of the VOC compounds, however, we report the CTR exceedance of two compounds, N-nitrosodiphenyl amine and pentachlorophenol.

Janelle Rogers, Ph.D., PE, Presenter – Background

Dr. Janelle D. Rogers is an environmental and civil engineer with 18 years experience in developing and managing water supply and wastewater projects and programs. A Principal at CDM, Janelle has performed water and wastewater work in the former Soviet Union, Central and Eastern Europe, Africa, the Middle East, Central America, the Caribbean, Latin America, and India as well as the United States. From 1992 through 1995, Janelle was a Science and Diplomacy Fellow for the American Association for the Advancement of Science. Janelle is the project manager for the Caltrans Construction Site Storm Water Runoff Characterization Study.

Janelle Rogers – Presentation Summary

Construction Runoff Monitoring

From 1998-2002, Caltrans collected storm water quality data from Caltrans construction sites. One of the primary purposes of the study was to develop a baseline of construction site storm water quality. Among others, two principal questions investigated by the study were (1) whether construction site runoff differs significantly from freeway and highway storm runoff, and (2) whether constituents found in storm water runoff from construction sites could be related to the type of construction project or activity. Results showed that storm water runoff from construction sites generally has a lower concentration of metals compared to highway runoff, storm water from new construction appears to have lower concentrations of metals than modifications to existing facilities, and storm water from construction sites generally has higher concentrations of total suspended solids and phosphorus compared to highway runoff.

Key Monitoring Issues – A Poster Display (continued)

Michael Stenstrom, Ph.D., PE, Presenter – Background

Michael K. Stenstrom is a Professor in the Civil and Environmental Engineering Department at the University of California, Los Angeles. He has a Ph.D. in Environmental Systems Engineering from Clemson University (1976) and is a registered professional engineer in California. He teaches undergraduate and graduate courses in water and wastewater treatment, mathematical modeling of environmental systems, and laboratory analysis.

Professor Stenstrom is a frequent consultant to various industries and municipalities who wish to improve their wastewater treatment. He is very familiar with the design and operation of municipal treatment systems and industrial treatment and pretreatment systems. In recent years, Professor Stenstrom has been working on stormwater management and the development of best management practices for stormwater in highly urbanized environments such as Los Angeles. He is a board member of Heal-the-Bay and co-chaired their Scientific Advisory Board.

Dr. Stenstrom has won several awards including the Harrison Prescott Eddy Prize for innovative research (Water Environment Federation), the Walter L. Huber Award (ASCE), the Best Dissertation Award (Association of Environmental Engineering and Science Professors), the Dow Environmental Care Award, and most recently the Los Angeles Basin Section (California WEF) Research Award.

Steve Kummerfeldt, PE, Presenter – Background

As part of the Senior Engineering Staff at URS Corporation, Mr. Kummerfeldt is the project manager for the Caltrans First Flush Characterization Study. Mr. Kummerfeldt received a Bachelor of Science Degree in Chemical Engineering from the University of California – San Diego, in 1982. He became a registered professional engineer in the State of California in 1999. His experience includes wastewater engineering design, construction, and treatment.

Michael Stenstrom and Steve Kummerfeldt – Presentation Summary

First Flush Characterization

The Caltrans First Flush Characterization Study (FFCS) collected and analyzed samples from storm events during the 1999-2002 storm seasons. The FFCS was conducted by URS Corporation and the Civil and Environmental Department of the University of California, Los Angeles. The FFCS evaluated the amount and concentration of litter and chemical constituents transported from Caltrans District 7 highway drainage facilities during the initial portion of a storm event (i.e., the "First Flush"). Water quality, litter and gross solid samples were collected by grab and automated sampling methods at six monitoring sites in Los Angeles, California. Samples were analyzed for total recoverable and dissolved metals, nutrients, Oil & Grease, Fecal and Total Coliform, and other parameters.

Storm water rainfall and flow data for each event were measured and developed into hydrographs, pollutographs, and loadographs. First Flush impacts were evaluated relative to the constituent concentration over an event and season, the Event Mean Concentrations (EMCs) between the initial samples collected and all of the samples collected, the instantaneous load generated across an event, and the fractional load. Correlations were reviewed among the various water quality parameters. The potential impacts of antecedent dry period and rainfall intensity on mass loading were also evaluated.

Key Monitoring Issues – A Poster Display (continued)

Xinjiang Huang, Ph.D., Presenter – Background

Dr. Huang is a post-doctoral researcher working with Professor Thomas Young's research group in the Department of Civil and Environmental Engineering at University of California-Davis. His current work is the evaluation of factors controlling herbicide runoff from Caltrans projects to surface waters. He leads a 10-person research team for this project. He supervises highway sampling and treatment station designs, lab analysis, and trains staff and student interns while coordinating with various Caltrans departments, a consulting company, and UC Davis. During the past three years, this group has monitored multiple runoff events at two sampling stations for the five herbicides that represent the properties of the 33 total herbicides currently used by Caltrans. Also, 36 statewide highway-monitoring sites have been surveyed and characterized for the properties related to herbicide runoff. At the project's conclusion, environmental technical guidance recommendations will be submitted to Caltrans' for its herbicide application program.

Xinjiang Huang, Michael Fischer, Richard White, Yun Lu and Thomas Young - Presentation Summary

Field Monitoring and Treatment of Herbicide Runoff from Highway Roadsides

As a successful highway vegetation management program, herbicides are usually applied by Caltrans to reduce weed growth along the roadside. However, the public is concerned that herbicides sprayed by Caltrans could negatively impact the environment, in particular aquatic life. In order to address this concern, this project was designed to determine whether best management practices currently employed by Caltrans adequately protect adjacent surface waters from herbicide runoff. Two geographically separated sites were selected from the northern parts of California. Different herbicides were applied in these two sites. Herbicides of Glyphosate, Oryzalin, and Isoxaben were applied along 1.3-meter wide roadside strip adjacent to the highway shoulder located on U.S. 101, at the north end of the Eel River Bridge, Rio Dell, California; while Oryzalin, Isoxaben, Transline, Diuron were applied on another site located at the north bank of Highway 37 in Sonoma County, California. Storm water traveling down the embankment was diverted with berms to a single point, then conveyed to an automated sampling station constructed downslope, where the runoff water was sampled by automatic samplers installed before and after a biomaterial treatment system. Herbicides in runoff were determined by HPLC, LC-MS and GC-MS. All data were analyzed to provide event mean concentrations (EMC) and loads (EML) for applied herbicides, precipitation amount and intensity, and runoff quantity for the first eight storms. Results from three years indicated that the herbicides were found in runoff water for all monitoring storm events with EMC ranging from 0.1 ug to 42.4 ug/L and EML from 1% to 41.9%, and the runoff concentration of herbicides decreased with sampling time; the concentration reduction of Oryzalin, Isoxben, and Diuron by the compost treatment system was above 60%, and were retarded by mulch treatment system.

Nathan Schaedler, PE, Presenter – Background

As a Senior Engineer at Law/Crandall, Inc., Nathan Schaedler is currently the Law/Crandall, Inc. project manager for the Caltrans Statewide Storm Water Runoff Characterization Study and District 7 BMP Retrofit Pilot Program Study projects. Mr. Schaedler received a Bachelor of Science Degree in Civil Engineering from the Cornell University, in 1993 and is a registered civil engineer in the State of California. He has been involved in the storm water field for the past nine years and

has experience in storm water, drinking water, and wastewater monitoring, regulatory compliance, planning, and design.

Nathan Schaedler – Presentation Summary

Monitoring Station

The Monitoring Station Display simulates how an auto sampler is typically installed and operates. The auto sampler displayed is a Sigma auto sampler that Caltrans typically uses to monitor storm water runoff. In order to simulate how the auto sampler operates and collects samples, a flow velocity meter and intake are installed in a clear, 6-inch pipe. Water is continually run through the pipe and the auto sampler collects samples from the pipe through the intake at a programmed pace. A flow meter is also installed in the pipe. Flow and sample collection information is continually displayed on the auto sampler display.

Supplementing the display of a typical auto sampler installation is a series of slides projected on a screen adjacent to the auto sampler setup and a map of the State of California. The slides show typical installations throughout the state, as well as unique monitoring station installations and site challenges. Adjacent to the slide show is a map of the State of California showing where monitoring stations are installed and the types of Caltrans facilities monitored.